MINERAL-BASED COMMODITIES FOR THE MANUFACTURING SECTOR

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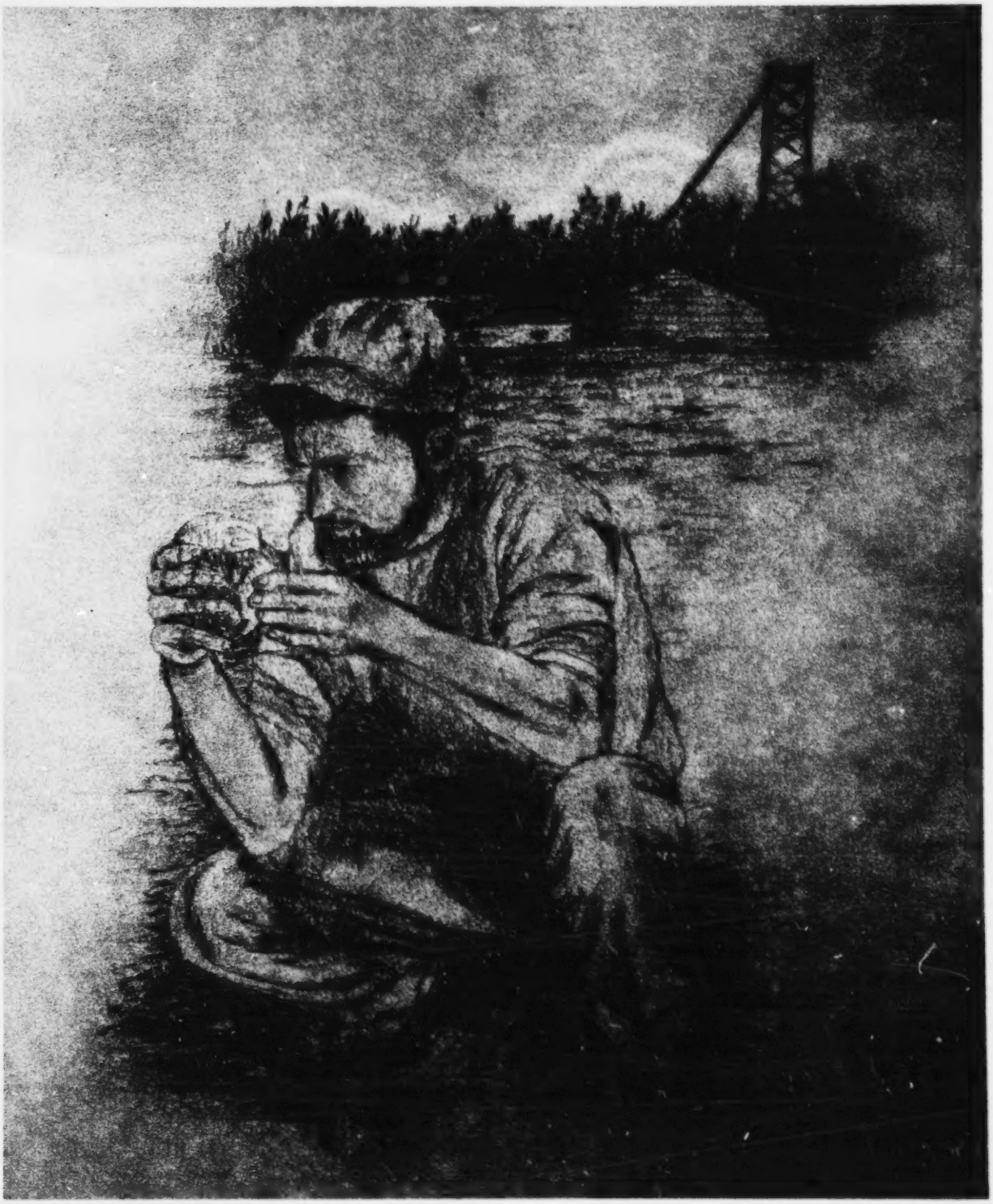

NATURAL RESOURCES AND ENERGY
NEW BRUNSWICK

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1986

NEW BRUNSWICK

MINERAL-BASED COMMODITIES

FOR THE MANUFACTURING SECTOR

Mineral Resources Division

Department of Forests, Mines and Energy

New Brunswick

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PREFACE

The Mining Act defines mining to include "any mode or method of working whereby the soil or earth or any rock, stone or material may be disturbed or removed, washed, sifted, roasted, smelted, refined, crushed or dealt with for the purpose of obtaining, for sale or barter, any mineral therefrom, whether the same may have been previously disturbed or not."

Through the Mining Act, the Department of Forests, Mines and Energy has jurisdiction with respect to the development and production of minerals and metals in New Brunswick.

Saleable concentrates and primary metals are generally produced at or near the mine site. These commodities and any final-finished products are commonly exported to other parts of the world.

After production to a saleable concentrate, prime metal, or final finished product stage, basic mineral resources are commonly exported to other parts of the world.

The basic metallic and nonmetallic minerals produced in New Brunswick have many uses. The purpose of this paper is to

(1) identify the metals, minerals and structural materials that are currently produced, and identify those with potential for production (with production and consumption statistics);

(2) identify the saleable forms (intermediate and final-finished) of each metal, mineral or structural material produced (with available consumption statistics);

(3) outline the uses for each saleable form.

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METALS

Uses and Production Statistics

Antimony
Bismuth
Cadmium
Copper
Gold
Lead
Silver
Zinc

ANTIMONY

Antimony is used in a number of alloys and chemicals. As an alloying material, antimony increases hardness, minimizes shrinkage, and lowers the melting point of type metals.

Antimonial lead alloys are used for power transmission and communications equipment, type metal, solder, ammunition, chemical pumps and pipes, tank linings, roofing sheets, and antifriction bearings.

Indium-antimony and aluminum-antimony alloys are intermetallic compounds used in electronic semiconductors and thermoelectric devices.

Antimony trioxide and antimony trichloride are used as fire retardants in such products as upholstery, carpets, plastics, insulations for electrical equipment and fibreglass materials. The trioxide is also a glass-former and imparts hardness and acid resistance to enamel coverings for bathtubs, sinks, toilet bowls and refrigerators. Trioxide is useful for producing a wide range of pigments in paints.

Metallic products that utilize antimony metal and its alloys include:

- ammunition
- antimonial lead
- bearing metal and bearings
- cable coverings
- castings
- collapsible tubes and foil (e.g., toothpaste tubes)
- sheet and pipe
- solder
- type metal

Nonmetallic products that utilize antimony include:

- ammunition primers
- fireworks
- flameproofing chemicals and compounds
- ceramics and glass
- pigments
- plastics
- rubber compounds

United States Antimony consumption:

Batteries.....	67.0%*
Antimonial lead...	16.0%
Type metal.....	8.4%
Solder.....	2.1%
Babbitt.....	1.5%
Others.....	5.0%

*American Bureau of Metal Statistics Inc. 1983 & 1984.

NEW BRUNSWICK ANTIMONY PRODUCTION

1972 - 1984

YEAR	VALUE ($)	VALUE (1984 $)	MINERAL PRODUCTION (% OF $ TOTAL)
1972	825 000	2 285 250	0.69
1973	2 656 000	6 827 513	1.64
1974	4 722 000	10 930 485	2.16
1975	5 900 000	12 342 800	2.54
1976	5 900 000	11 478 450	2.31
1977	6 463 000	11 645 033	2.41
1978	5 590 000	9 254 804	1.83
1979	7 726 000	11 705 662	1.46
1980	6 014 000	8 272 257	1.49
1981	2 760 000	3 373 824	0.52
1982	1 293 000	1 427 084	0.26
1983	589 000	614 798	0.12
1984	827 000	827 000	0.14

BISMUTH

Bismuth is used mainly in pharmaceuticals, fusible alloys, and as metallurgical additives.

Pharmaceutical products include cosmetics, industrial and laboratory supplies (including catalytic compounds), and various bismuth compounds, salts and mixtures used as indigestion remedies, antacids, and burn and wound dressings. Bismuth oxychloride imparts a 'pearlescent' glow to eye shadow, lipstick, nail polish and powders.

Fusible alloys. Low-melting alloys are used in fire-protection devices, electrical fuses, fusible plugs and solders. In safety applications, the dependability of the melting temperatures of the bismuth alloy compositions is of utmost importance.

As a metallurgical additive, bismuth improves the machinability of aluminum alloys and malleable iron and steel alloys. With indium, it forms a low-melting alloy used in the ophthalmic industry for holding lenses. Bismuth is used in many nuclear research applications because of the metal's low thermal neutron absorption rate.

Other uses of bismuth are found in the rubber industry, where a bismuth compound is used to accelerate the vulcanization process. Bismuth compounds are also catalysts in the production of acrylonitrile for acrylic fibres and plastics.

United States
Bismuth consumption:

Pharmaceutical products.....	51%*
Fusible alloys.....	27%
Metallurgical additives.....	20%

*ASBM 1983 & 1984

NEW BRUNSWICK BISMUTH PRODUCTION

1968 - 1984

YEAR	QUANTITY (kg)	VALUE ($)	VALUE (1984 $)	MINERAL PRODUCTION (% OF $ TOTAL)
1968	14 969	43 000	459 802	0.16
1969	25 855	281 000	864 609	0.30
1970	18 144	249 000	743 265	0.24
1971	17 267	205 000	594 193	0.19
1972	19 690	50 000	138 500	0.04
1973	28 577	308 000	791 745	0.19
1974	5 443	97 000	224 536	0.04
1975	134 266	2 327 000	4 868 084	1.00
1976	130 183	2 122 000	4 128 351	0.83
1977	135 173	1 895 000	3 414 411	0.71
1978	136 080	1 156 000	1 913 874	0.38
1979	68 040	531 000	804 518	0.10
1980	135 000	1 002 000	1 378 251	0.25
1981	146 000	1 017 000	1 243 181	0.19
1982	161 000	966 000	1 066 174	0.19
1983	166 000	847 000	884 099	0.17
1984	159 000	1 879 000	1 879 000	0.31

CADMIUM

Cadmium is used in electroplating, in pigments and chemicals, batteries, alloys, and as a catalyst.

Electroplating of iron and steel products to protect them against oxidation is cadmium's major use. As a coating, cadmium is usually preferred to zinc because it is more ductile, can be applied more uniformly in recesses of intricately shaped parts, has a more aesthetic appearance, and gives greater protection with the same thickness of plating. The high ductility of cadmium is an advantage where the plated parts are to be formed. The good soldering characteristics of cadmium plate is an advantage in electrical operations.

Pigments and chemicals represent the second largest use of cadmium. Cadmium sulphides produce yellow to orange colours and cadmium sulphoselenides produce pink, red and maroon colours. Pigments containing cadmium demonstrate good reflectance, heat stability and colour intensity. Cadmium compounds are used as stabilizers in the production of plastics, and cadmium phosphors are used in television picture tubes.

Cadmium-bearing batteries (such as nickel-cadmium, silver-cadmium, and mercury-cadmium) have the advantage of long life, maximum current delivery with a low voltage drop, small size, excellent performance under a wide temperature range, and a low rate of self-discharge. They are widely used in aircraft, satellites, missiles, calculators, and a broad assortment of portable tools and appliances.

Cadmium is also used as a catalyst in the production of primary alcohols and esters, in low-melting alloys (used in fire detection devices), bearing alloys, brazing alloys and solders, and copper hardeners for railway catenary and trolley wires.

NEW BRUNSWICK CADMIUM PRODUCTION

1964 - 1984

YEAR	QUANTITY (kg)	VALUE ($)	VALUE (1984 $)	MINERAL PRODUCTION (% OF $ TOTAL)
1964	10 433	74 000	273 060	0.15
1965	19 051	116 000	417 264	0.14
1966	17 237	97 000	336 803	0.11
1967	23 587	144 000	481 594	0.16
1968	30 845	194 000	623 788	0.22
1969	49 896	388 000	1 193 837	0.41
1970	72 122	566 000	1 689 510	0.54
1971	61 236	262 000	759 407	0.24
1972	14 062	80 000	221 600	0.07
1973	-	-	-	-
1974	24 494	215 000	497 682	0.10
1975	24 041	182 000	280 744	0.08
1976	24 041	139 000	270 424	0.08
1977	18 144	127 000	228 829	0.05
1978	-	-	-	-
1979	-	-	-	-
1980	-	-	-	-
1981	-	-	-	-
1982	-	-	-	-
1983	24 948	169 000	176 402	0.03
1984	-	-	-	-

COPPER

Copper is used in the manufacture of brass and other alloys, chemicals (oxides, hydroxides, sulphates), munitions, coinage and jewellery.

Copper products include:
- pipes and tubes
- plates and sheets
- wire and cable (bare)
- wire and cable (insulated)
- rods, bars and sections
- strip and foil
- tubes (solid drawn, circular)
- hollow bars

Copper consumption:

Building and construction.....	42.2%
Electrical and electronic.....	16.4%
Industrial machinery and equipment	15.2%
Consumer and general products.....	14.6%
Transportation equipment.....	11.6%

Reference:

A.D.I. Limited. 1979. New Brunswick Manufacturers Opportunities Identification. A.D.I. Limited, File No. 337-53. (Commerce & Development Library No. 0224 9)

NEW BRUNSWICK COPPER PRODUCTION

1958 - 1984

YEAR	QUANTITY (kg)	VALUE ($)	VALUE (1984 $)	MINERAL PRODUCTION (% OF $ TOTAL)
1958	297 562	167 000	665 328	1.03
1959	-	-	-	-
1960	-	-	-	-
1961	-	-	-	-
1962	3 333 053	2 278 000	8 694 443	10.44
1963	8 132 141	5 647 000	21 149 709	19.92
1964	8 433 331	6 210 000	22 914 900	12.75
1965	9 145 937	7 581 000	27 269 615	9.23
1966	6 431 594	6 366 000	22 104 025	7.06
1967	5 249 059	5 505 000	18 410 025	6.09
1968	7 498 008	7 951 000	25 565 645	8.99
1969	6 160 342	6 985 000	21 492 146	7.38
1970	7 277 558	9 314 000	27 802 290	8.89
1971	9 313 315	10 841 000	31 422 638	10.11
1972	9 353 686	10 052 000	27 844 040	8.36
1973	9 353 232	13 155 000	33 816 243	8.10
1974	10 235 030	17 580 000	40 694 184	8.04
1975	11 212 084	15 758 000	32 965 736	6.79
1976	9 677 556	14 587 000	28 379 008	5.72
1977	13 226 976	20 257 000	36 499 062	7.56
1978	10 710 856	17 570 000	29 088 892	5.74
1979	10 913 616	25 691 000	38 924 434	4.84
1980	9 651 000	25 286 000	34 780 893	6.27
1981	12 034 000	26 629 000	32 551 289	5.00
1982	13 125 000	25 610 000	28 265 757	5.14
1983	11 369 000	23 754 000	24 794 425	4.67
1984	7 186 000	13 631 000	13 631 000	2.25

GOLD

Gold is used in jewellery, coinage, electronics, dentistry, and as an investment.

The use of gold in jewellery is subject to the cost of gold. When prices are low the sale of jewellery is brisk.

Coinage (medals, medallions, fake coins) sales have improved. However, dishoarding of jewellery and coins occur during periods of high gold prices.

Electronic components made from gold are less used as a result of the substitution of silver/nickel and platinum/nickel alloys. The trend toward microminiaturization and the development of microchips with greater capacity also reduces the consumption of gold. Despite overall growth in the electronics industry, consumption of gold has decreased over the last few years. This trend is forecasted to continue.

Dentistry applications for the use of gold have also declined as a result of increasing emphasis on dental care.

As an investment, gold is traded or hoarded, depending on the market conditions. A significant amount of gold is hoarded in the Middle East and Far East countries and is used in local trading. The volume traded on the gold futures market increased over the past few years. Short selling by speculators in this market can have a disproportionate effect on price, and increases the volatility of the market , causing uncertainty for producers and consumers.

NEW BRUNSWICK GOLD PRODUCTION

1958 - 1984

YEAR	QUANTITY (gm)	VALUE ($)	VALUE (1984 $)	MINERAL PRODUCTION (% OF $ TOTAL)
1958	-	2 000	7 968	0.01
1959	-	-	-	-
1960	-	-	-	-
1961	-	-	-	-
1962	155 515	21 000	80 150	0.10
1963	31 103	43 000	161 047	0.15
1964	62 206	61 000	225 090	0.13
1965	62 206	63 000	226 617	0.08
1966	62 206	74 000	256 942	0.08
1967	31 103	54 000	180 597	0.06
1968	62 206	83 000	858 120	0.09
1969	31 103	53 000	163 075	0.06
1970	155 515	187 000	558 195	0.18
1971	124 412	150 000	434 775	0.14
1972	93 309	185 000	512 450	0.15
1973	155 515	507 000	1 303 294	0.31
1974	124 412	700 000	1 620 360	0.32
1975	93 309	555 000	1 161 060	0.24
1976	124 412	460 000	894 930	0.18
1977	217 721	1 157 000	2 084 682	0.43
1978	217 721	1 551 000	2 567 835	0.51
1979	186 618	2 061 000	3 122 621	0.31
1980	275 000	5 803 000	7 982 026	1.44
1981	196 000	3 482 000	4 256 396	0.65
1982	205 000	3 065 000	3 382 840	0.61
1983	346 000	5 790 000	6 043 602	1.14
1984	502 000	7 573 000	7 573 000	1.25

LEAD

Lead is the only metal refined in New Brunswick.

Lead is used in the manufacture of numerous metal products, pigments, chemicals, and in petroleum refining.

Metal products include the following:

	%**
Ammunition (shot and bullets)	3.914
Bearing metals, total	0.399
machinery, except electrical (0.059)*	
electrical and electronic equipment (0.004)	
motor vehicles and equipment (0.197)	
other transportation equipment (0.137)	
Brass and bronze (billets and ingots)	1.110
Cable covering, power and communications	1.040
Calking lead, building construction	0.330
Casting metals, total	1.737
electrical machinery and equip. (0.144)	
motor vehicles and equipment (0.067)	
other transportation and equip. (1.525)	
nuclear radiation shielding	
Pipes, traps and other extruded products, total	0.786
building construction (0.748)	
storage tanks, process vessels, etc. (0.038)	
Sheet lead, total	1.521
building construction (0.939)	
storage tanks, process vessels, etc. (0.014)	
medical radiation shielding (0.567)	
Solder, total	2.637
building construction (0.667)	
metal cans and shipping containers (0.522)	
electronic components and accessories (0.560)	
other electrical machinery and equipment (0.254)	
motor vehicles and equipment (0.631)	
Storage battery grids, posts, etc., total	32.776
storage batteries, SLI automotive (30.143)	
storage batteries, industrial and traction (2.632)	
Storage battery oxides, total	32.938
storage batteries, SLI automotive (34.135)	
storage batteries, industrial and traction (1.803)	

* numbers in brackets () indicate % consumption of individual products.

**American Bureau of Metal Statistics Inc. 1984.

Terne metal, motor vehicles and equipment	0.489**
Type metal, printing and allied industries	0.015
Other metal products (lead consumed in foil, collapsible tubes, fishing weights, annealing, galvanizing, plating)	0.532

Pigments that contain lead are used in:

Paints	1.490
Glass and ceramic products	3.521
Other pigments, including leaded zinc oxide colour	1.287

Chemicals-petroleum refining

Lead consumption:	Metal products	77.300%
	Chemical-petroleum refining	8.595%
	Pigments	6.298%
	Miscellaneous uses	1.850%

**American Bureau of Metal Statistics Inc. 1983 & 1984.

NEW BRUNSWICK LEAD PRODUCTION

1958 - 1984

YEAR	QUANTITY (kg)	VALUE ($)	VALUE (1984 $)	MINERAL PRODUCTION (% OF $ TOTAL)
1958	85 276	21 000	83 664	0.13
1959	-	-	-	-
1960	-	-	-	-
1961	-	-	-	-
1962	1 705 082	373 000	1 423 629	1.71
1963	1 617 538	392 000	1 468 158	1.38
1964	19 700 755	5 837 000	21 538 530	11.99
1965	39 602 908	13 533 000	48 679 554	16.47
1966	47 051 474	15 497 000	53 808 683	17.18
1967	42 653 368	13 165 000	44 029 026	14.56
1968	49 306 320	14 609 000	46 973 778	16.52
1969	46 350 662	15 501 000	47 695 026	16.39
1970	56 858 760	19 830 000	59 192 550	18.92
1971	59 335 416	17 659 000	51 184 611	16.47
1972	41 268 981	14 036 000	38 879 720	11.68
1973	39 927 232	14 207 000	36 520 514	8.75
1974	45 623 088	20 825 000	48 205 710	9.52
1975	59 093 647	26 399 000	55 226 708	11.38
1976	61 687 785	30 808 000	59 936 964	12.08
1977	61 142 558	41 991 000	75 659 383	15.68
1978	70 878 175	57 539 000	95 261 568	18.79
1979	75 674 088	99 319 000	150 478 210	18.72
1980	48 673 000	53 170 000	73 135 335	13.18
1981	68 373 000	67 108 000	82 032 819	12.60
1982	81 475 000	59 069 000	65 194 455	11.85
1983	70 346 000	41 518 000	43 336 488	8.16
1984	73 250 000	53 890 000	53 890 000	8.92

SILVER

Silver is used in the following products:

	Approximate %*
Photographic supplies	42.0
Electrical and electronic products, including	
contacts and conductors	24.0
batteries	4.0
Brazing alloys and solders	7.0
Jewellery	6.0
Sterling ware	6.0
Electroplated ware	3.0
Catalysts	2.0
Dental and medical supplies	1.0
Coins, medallions and commemorative objects	1.0
Mirrors	1.0
Miscellaneous, including silver-bearing copper, silver-bearing lead anodes, ceramic paints	4.0

*A.B.M.S. 1983 & 1984.

NEW BRUNSWICK SILVER PRODUCTION

1958 - 1984

YEAR	QUANTITY (kg)	VALUE ($)	VALUE (1984 $)	MINERAL PRODUCTION (% OF $ TOTAL)
1958	1 586	44 000	175 296	0.27
1959	-	-	-	-
1960	-	-	-	-
1961	-	-	-	-
1962	5 567	208 000	793 874	0.95
1963	10 015	460 000	1 722 838	1.62
1964	45 690	2 057 000	7 590 330	4.23
1965	85 378	3 843 000	13 823 655	4.68
1966	96 699	4 349 000	15 100 597	4.82
1967	93 838	5 226 000	17 477 834	5.78
1968	113 650	8 752 000	27 176 560	9.55
1969	126 247	7 834 000	24 104 434	8.28
1970	142 390	8 469 000	25 279 965	8.08
1971	157 319	7 890 000	22 869 165	7.36
1972	121 488	6 524 000	18 071 480	5.43
1973	111 007	9 014 000	23 171 388	5.55
1974	136 293	20 222 000	46 809 885	9.24
1975	157 039	22 752 000	47 597 184	9.81
1976	156 106	21 497 000	41 822 413	8.43
1977	173 182	27 370 000	49 315 266	10.22
1978	178 811	35 429 000	58 656 252	11.57
1979	196 260	74 906 000	113 490 080	14.12
1980	124 000	97 649 000	134 316 190	24.20
1981	193 000	78 215 000	95 610 016	14.69
1982	230 000	72 719 000	80 259 960	14.59
1983	198 000	89 959 000	93 899 204	17.69
1984	136 000	47 704 000	47 704 000	7.90

ZINC

Zinc is used mainly in galvanizing, brass and bronze, zinc-base alloys, rolled zinc and zinc oxide.

Galvanizing is a method of protecting the surface of materials from corrosion. It is applied to:

	American Consumption %*
Sheet and strip metals	28.59
Wire and wire rope	2.20
Tubing and pipe	4.25
Fittings (for tubing and pipe)	0.75
Tanks and containers	0.67
Structural shapes	3.69
Fasteners	0.33
Pole-line hardware	0.38
Fencing, wire cloth and netting	1.97
Other uses	3.00

Brass and bronze are used in the following:

Strip, sheet and plate	5.40
Rod and wire	4.70
Tubing	0.56
Casting and billets	0.66
Copper-base ingots	2.03
Other copper-base products	0.39

Zinc-base alloys are used in the following:

Die casting alloy	26.51
Dies and rod alloy	---
Slush and sand casting alloy	0.91

Rolled zinc

Zinc oxide

Other uses for zinc are in wet batteries, desilverizing lead, and light-metal alloys.

*American Bureau of Metal Statistics Inc. 1983 & 1984.

NEW BRUNSWICK ZINC PRODUCTION

1958 - 1984

YEAR	QUANTITY (kg)	VALUE ($)	VALUE (1984 $)	MINERAL PRODUCTION (% OF $ TOTAL)
1958	2 868 112	688 000	2 704 992	4.23
1959	-	-	-	-
1960	-	-	-	-
1961	-	-	-	-
1962	2 266 186	605 000	2 309 103	2.77
1963	9 629 020	2 713 000	10 160 998	9.57
1964	49 325 824	15 409 000	56 859 210	31.66
1965	112 124 930	37 326 000	134 265 350	45.43
1966	129 181 190	43 003 000	149 315 010	47.67
1967	137 311 070	43 863 000	146 695 410	48.50
1968	122 861 640	38 191 000	122 799 340	43.17
1969	138 101 240	46 521 000	143 140 460	49.18
1970	146 144 470	51 325 000	153 205 120	48.97
1971	146 525 500	57 043 000	156 643 630	50.40
1972	158 339 050	66 572 000	184 404 440	55.39
1973	174 692 700	92 992 000	239 045 230	57.27
1974	158 554 970	121 922 000	282 225 040	55.73
1975	149 212 170	123 357 000	258 062 840	53.18
1976	171 736 130	142 432 000	277 101 450	55.83
1977	161 811 820	124 965 000	225 161 930	46.65
1978	171 607 310	131 494 000	217 701 460	42.93
1979	264 584 420	255 117 000	386 527 760	48.09
1980	144 122 000	138 533 000	190 552 140	34.33
1981	228 608 000	273 369 000	334 166 260	51.15
1982	230 299 000	247 110 000	272 735 300	49.57
1983	225 054 000	258 655 000	269 984 080	50.85
1984	246 424 000	346 719 000	346 719 000	57.42

METALS

Major Potential for Production

Manganese
Molybdenum
Tin
Tungsten

MANGANESE

There is potential for production of manganese from the Woodstock area of New Brunswick.

Manganese is important in the steel and chemical industries, it has many alloying and nonmetallurgical applications.

In the steel industry, manganese is used as a desulphurizer. It combines with sulphur to produce a manganese sulphide slag that is easily separated from the steel. Iron used for castings is desulphurized with manganese. Manganese metal also acts as a deoxidizer during the steelmaking process.

Steel mills in Canada use about 5.8 kg of manganese per tonne of crude steel produced.

Specialty steels that contain between 10 and 14 per cent manganese are extremely hard and tough.

Alloys are formed by combining manganese and nonferrous metals. Aluminium-manganese alloys are noted for their strength, hardness and rigidity. Manganese-magnesium alloys are hard, rigid and corrosion resistant. Corrosion-resistant manganese bronzes are used in ship propellers.

A nonmetallurgical application for manganese is in dry-cell batteries. Oxygen, provided by manganese dioxide, combines with hydrogen to permit the battery to operate at maximum efficiency.

In the chemical industry, manganese has a number of uses. Potassium permanganate is a powerful oxidant used in the purification of public water supplies. Manganese oxide is an important addition to welding rods and fluxes.

An organometallic form of manganese inhibits smoke formation and improves the combustion of fuel oil.

Manganese is a colour agent in face bricks and, to a lesser extent, is used to colour or decolour glass and ceramics.

MOLYBDENUM

There is potential for production of molybdenum from the Mount Pleasant deposit and other smaller deposits in New Brunswick.

The iron and steel industry is the largest single consumer of molybdenum, accounting for about 85 per cent of total consumption; of this, 65 per cent is utilized as oxide and 20 per cent as ferromolybdenum. Other usage accounts for 15 per cent; of this, 5 per cent is used as metal and 10 per cent as molybdenum disulphide and other chemicals.

In the steel industry, molybdenum is used to increase strength at normal and high temperatures, and to increase resistance to corrosion. In low concentrations, molybdenum is used in high-speed tool steels and in abrasion resistant machinery and parts.

Molybdenum is used as a catalyst in the petroleum and chemical industries (to desulphurize petroleum products and chemicals), in metal and base alloys for high temperature applications, in thermocouples, electronics, missle parts, structural components of nuclear reactors, and in the production of pigments for inks, lacquers and paints.

Products by end use:

- Steels
  - carbon
  - stainless and heat resisting
  - full alloy
  - high strength, low alloy
- Tool
- Cast irons
- Super alloys
- Other alloys
  - welding rods and materials
  - hard-facing rods and materials
  - magnetic alloys
  - nonferrous alloys
- Mill products made from metal powder
- Chemical and ceramic uses
  - pigments
  - catalysts

TIN

(Potential from Mt. Pleasant)

Tin plate, used in the can-making industry, is unequalled as a protective, nontoxic, hygienic coating on steel.

Solders are used in tin can seams, the electronics industry, and in automobile radiator cores. Lead-rich body-filling solders are used in the automotive industry.

The silver content of tin-silver solders increases hardness (by 30%), tensile strength, and shear strength. Nontoxic tin-silver solders are used in plumbing, heating, refrigeration and air conditioning, food-service and processing utensils, holloware, and the electronics industry.

Babbitt and white metal alloys are used in bearings, pewter, britannia and jewellers' metal. Pewter contains approximately 91% tin, 7% antimony and 2% copper; the antimony and copper act as hardeners. A few uses of pewter include dinnerware, jewellery, and commemorative coins.

Tin is used in a number of other alloys. Copper-tin alloys are used in gunmetal, bronze, and bell metal. Titanium-tin alloys are used in the aerospace industry (primarily in supersonic jets).

Terneplate (lead-tin alloy) is used in roofing material, automotive oil filters, critical body parts (e.g., undersides of electric golf carts), and in some fixtures.

Galvo-Terneplate is cold-rolled sheet metal that is electrolytically coated with an alloy of 88% lead and 12% tin . It is used for corrosion-resistant car parts (e.g., gasoline tanks) because of its resistance to many chemicals.

Fusible alloys of tin, bismuth, lead, cadmium and indium are used in safety devices such as heat fuses.

Die-casting alloys of tin, antimony and copper have applications in the production of jewellery.

Minor alloys of tin include copper-tin-aluminium alloy (condenser tubes), super conductive alloys such as intermetallic Nb_3Sn, and lead-calcium-tin alloys (now being introduced in batteries).

Tin chemicals are used as catalysts in silicone elastomers (also known as semiplastic sealants), in polyurethane foam technology and in the construction industry.

Triphenyltin fungicides are used in agriculture; tributyltin is used in industrial biocides and disinfectants.

The inorganic compounds stannous chloride, stannous sulphate, sodium stannate, and potassium stannate are used as electrolytes in the tin-plating process. The chloride also stabilizes the colour and perfume of soap.

Pure tin is used mainly for pharmaceutical products (e.g., collapsible tubes). It is also used in the electronics industry to produce semiconductors, such as tin-lead telluride, for advanced solid-state radiation detection devices.

Tin consumption in the U.S.A.:	Tin plate	25.0%*
	Solders	27.6%
Tin chemicals		10.0%
Babbitt and white metal alloys		7.6%
Other alloys		6.3%

*American Bureau of Metal Statistics 1983 & 1984.

TUNGSTEN

(Potential from Mount Pleasant)

Tungsten materials are divided into several major classes, depending upon the product form and its use. The main product classes are tungsten carbide, tungsten-bearing steels, super alloys, mill products, and chemicals.

Tungsten carbide is one of the hardest materials known. It is extensively used in the tool and die industries. Cutting tools of cemented tungsten carbide are used for machining steel, cast iron and nonferrous metals, and for shaping in the woodworking and plastic industries. It is also used to make dies for wire and tube drawing, punches and dies for metal forming, bits and tools for drilling equipment and wear-resistant parts. Other uses are in tire studs, spikes for golf shoes, armour-piercing projectiles and welding electrodes.

Tungsten-bearing steels have the same applications as carbides, especially where lower operating temperatures are encountered. Tungsten is also used in some stainless steels for application in high-temperature environments.

Super alloys of tungsten (nickel-base, iron-base and cobalt-base) are used extensively in high-temperature applications and in highly corrosive environments because of their high-temperature strength and oxidation resistance.

Mill products made from pure or nearly pure tungsten metal powder are used in significant quantities by the electrical industry because of their high melting point, low vapour pressure, hardness, good electrical conductivity, and low coefficient of thermal expansion.

Rod, wire and flat products are made by compressing tungsten powder into the desired shape and then sintering. Because of resistance to heat deformation, tungsten discs (cut from rods) are used in electrical contacts, ignition circuits of automobiles and aircraft. They are also used as heat sinks in semiconductor applications and, in combination with other elements, as electrical contacts and breakers for industrial use.

Tungsten wire is used for filaments in incandescent lamps, and heating elements in both fluorescent lamps and vacuum tubes. New uses of tungsten wire are in de-icing and defogging elements in the automobile industry.

Flat products are used for various parts of electron tubes and radiation shields, and for very high temperature applications in reducing or inert atmospheres.

Chemicals containing tungsten are used in small volumes throughout the chemical industry. Sodium tungstate, phosphotungstic acid and phosphotungstomolybdic acid are used in dyes, toners, phosphors, chemical reagents, corrosion inhibitors and catalysts.

METALS

Minor Potential for Production and/or not Actively Sought

Beryllium
Calcium
Cobalt
Indium
Magnesium
Platinum Group

BERYLLIUM

Beryllium-copper alloys (0.25-2.15% Be) are the most used of the beryllium alloys, and are produced in wrought or cast forms. Their increased strength, hardness and conductivity make them excellent for use in springs, electrical/electronic connectors and contacts, diaphrams, injection molds for plastic, and for some applications in oil and gas drilling.

Beryllium metal has a superior strength and stiffness relative to density, which allows its use in the aerospace industry for structural applications, navigational systems, and aircraft brakes. Unalloyed beryllium is also used in weapons, spacecraft, nuclear reactor reflector segments, neutron sources, windows for X-ray tubes and radiation detection devices, rocket nozzles, precision instruments, and mirrors.

Beryllium oxides have excellent insulating properties, high thermal conductivity and thermal shock resistance. Applications include heat sinks, lasers and substrata for dense electronic circuits. Beryllium oxide has superior microwave transmission characteristics and is used for radomes and microwave windows.

Beryl is used in jewellery in the form of gem stones. When pure, the mineral is colourless, but impurities impart a variety of colours to produce gems such as the green-coloured emerald and the sea blue variety called aquamarine.

United States
Beryllium consumption: Defense and energy.....90%

CALCIUM

Metallic calcium is used as a reducing agent in the preparation of thorium, zirconium, uranium, chromium, vanadium, columbium, tantalum, plutonium, titanium, tungsten, and yttrium.

It is also used as a deoxidizer, decarburizer or desulfurizer for various ferrous and nonferrous alloys. In nonferrous metallurgy, it is used to debismuthize lead and, as an alloying additive, to harden lead-plate storage-battery grids in the "maintenance free" battery.

In ferrous metallurgy, calcium metal, calcium compounds, and ferro-silicon alloys are used to control grain size, inhibit carbide formation, improve ductility, and reduce internal flaws in castings.

Other uses of calcium are as a reducing agent in manufacturing rare-earth magnetic alloys, in the preparation of Vitamin B, and in a number of chemicals. It is used as an alloying or modifying agent for aluminium, beryllium, copper, lead, tin and magnesium alloys. Calcium is a getter for residual gases in vacuums and vacuum-tube applications, and is a reagent for purification and scavenging of inert gases.

COBALT

Cobalt-base superalloys (45% Co) are high-strength materials that are wear- and corrosion-resistant at elevated temperatures. They are used in the turbine blades of aircraft jet engines and the gas turbines of gas pipelines.

Nickel- and iron-base superalloys contain 8 to 20 per cent cobalt.

Cobalt-base alloys of the stellite group contain cobalt, tungsten, chromium, and molybdenum as principal constituents. Hardfacing or coating of tools with cobalt alloys provides greater resistance to abrasion, heat, impact and corrosion.

Cobalt metal powder is used as a binder in making cemented tungsten carbides for heavy-duty and high-speed cutting tools.

Chemical products (paint, glass and cramics) contain cobolt oxide, an important additive. A cobalt-molybdenum-alumina compound is used as a catalyst in hydrogenation and in petroleum desulphurization. Cobalt also improves the adherence of enamel to steel (e.g., in appliances), and steel to rubber (e.g. steel-belted tires).

INDIUM

(Potential from Mt. Pleasant)

Low-melting alloys have major applications in solders and fusible alloys that can be designed to fit a particular melting point requirement by varying the indium content in the alloy.

The electronics industry uses indium in germanium transistors, diodes, and rectifiers. It is used in low-pressure sodium lamps and as surface coating on aluminium wire conductors for low-resistance contacts and terminals.

Other applications are in dental alloys, semi-conductors, radiation detector badges, surface lubricants and for protective finishes. Alloys of indium are used also in bearings, protective finishes on jewellery and silverware. A silver-cadmium-indium alloy is used in nuclear reactor control rods. Alloys are also used as holding parts in the machining, grinding and polishing of glass lenses and ceramics.

MAGNESIUM

Aluminum alloys account for the greatest consumption of magnesium. Because of its high strength-to-weight ratio, magnesium is used in structural applications, i.e., those which involve load-carrying components. Typical uses are in aircraft (particularly helicopters), missiles and space exploration vehicles, luggage frames, and material-handling equipment such as gravity conveyors and hand trucks. Magnesium castings are used extensively in power lawnmowers, chain saws, typewriters, and electronic equipment.

In non-structural applications, magnesium is used as an alloying element for ductile iron, as a reducing agent in the production of titanium, for cathodic protection, as Grignard reagents in the chemical industry, and as anti-knock fuel additive.

Magnesium is a desulphurizing agent in the manufacture of steel. While consumption in this sector is low, it is expected to grow rapidly.

PLATINUM GROUP

The special properties of the platinum group of metals that make them important in manufacturing are their suitability for catalytic activity, resistance to corrosion and oxidation at elevated temperatures, good electrical conductivity, high melting point, high strength, ductility, and aesthetic qualities. Platinum and palladium have wide industrial applications, especially in the catalytic field. Iridium, rhodium, ruthenium, and osmium are used mainly as alloying elements with platinum and palladium, but small amounts are used individually in special applications.

In the automotive industry, platinum-palladium converters are now used to control car exhaust emissions.

Electrical products include printed circuits, electric furnaces, thermocouples, and electrical contacts for telephone equipment.

In the chemical industry, platinum catalysts are used in petroleum reforming to produce high octane gasoline. Platinum alloyed with other platinum group metals is used in the chemical industry as catalysts, in the production of pharmaceutical products, and in the food processing industry.

The platinum-rhodium alloy is used for bushings and spinnerets in the production of fibre glass, synthetic fibres, and in the glass manufacturing industry.

Other uses for platinum are in laboratory equipment, medical research, fuel cells for direct generation of electric current, and crucibles for growing laser crystals and synthetic gems.

United States
Platinum consumption:

Automotive	36%*
Electrical	21%
Dental and medical	19%
Chemical	9%
Petroleum	5%
Glass	1%
Jewellery and decorative	1%
Others	8%

*A.B.M.S. 1983 & 1984.

NONMETALS

Uses and Production Statistics

Gypsum and Anhydrite
Peat
Potash
Quartz (Silica and Silicon)
Salt
Sulphur Dioxide and Sulphuric Acid

GYPSUM ($CaSO_4 \cdot 2H_2O$) & ANHYDRITE ($CaSO_4$)

Gypsum (hydrous calcium sulphate), that is calcined at temperatures ranging from 120° to 205° releases three-quarters of its chemically combined water. The resulting hemihydrate of calcium sulphate is commonly referred to as plaster of Paris.

When mixed with water, plaster of Paris can be moulded, shaped or spread, and subsequently dried or set, to form a hard plaster. It is used in gypsum wallboard, lath, and tile and interior wall finishes.

Keene's cement is produced from crushed gypsum that is converted to insoluble anhydrite by calcining at temperatures as high as 700°C. The ground calcine, mixed with a set accelerator, produces a harder and stronger plaster product than ordinary gypsum plaster.

Portland cement is made from crude gypsum that acts as a retarder to control set. It is used as a filler in paint and paper, as a substitute for salt cake in glass manufacture, and as a soil conditioner.

Anhydrite is used in the manufacture of Portland cement and as a peanut crop fertilizer.

NEW BRUNSWICK GYPSUM PRODUCTION

1958 - 1984

YEAR	QUANTITY (TONNES)	VALUE ($)	VALUE (1984 $)	MINERAL PRODUCTION (% OF $ TOTAL)
1958	96 189	171 000	681 264	1.05
1959	88 929	133 000	523 621	0.74
1960	82 577	267 000	1 038 897	1.56
1961	77 132	137 000	528 957	0.73
1962	83 485	162 000	618 305	0.74
1963	73 503	139 000	520 597	0.49
1964	94 373	215 000	793 350	1.44
1965	91 651	211 000	758 988	0.26
1966	98 004	413 000	1 434 019	0.46
1967	80 762	182 000	608 681	0.20
1968	77 132	173 000	556 264	0.20
1969	73 503	135 000	415 382	0.14
1970	66 243	157 000	468 645	0.15
1971	69 873	259 000	750 712	0.24
1972	68 058	220 000	609 400	0.18
1973	83 484	266 000	683 780	0.16
1974	82 577	300 000	694 440	0.14
1975	52 632	209 000	437 228	0.09
1976	41 742	177 000	344 354	0.07
1977	42 650	201 000	367 567	0.08
1978	57 169	379 000	627 472	0.12
1979	51 724	424 000	642 402	0.08
1980	42 000	201 000	276 476	0.05
1981	20 000	87 000	106 349	0.02
1982	-	-	-	-
1983	-	-	-	-
1984	-	-	-	-

PEAT

Present peat production in New Brunswick is in the form of:

- Baled peat moss
- Soil mixtures with peat as a base
- Peat pots
- Peat pellets

Jiffy Products (N.B. Limited) produces peat pots and pellets, and is considering the manufacture of pots and pellets specifically for tree seedlings.

Peat waxes are used in furniture wax, shoe polish, glazed paper, cosmetic preparations and salves, in foundry castings as mold release agents. It is a release and antiblocking agent on polyurethane surfaces, especially for interior automobile parts. Peat waxes can be used for the production of phonograph records, as a paint-waterproofing agent, in candle production, electrical insulation, paper sizing, carbon paper coatings, leather dressings, inks, and greases. In the plastics industry, peat waxes can also be used in the lost-wax process of casting.

Peat resins and steroids include cold-methanol resins, ethanol resin, B-Sitosterol, and B-Sitostanol steroids.

Peat carbohydrates include pectins (hot-water soluble), hemicelluloses, chitin, glycosides, cellulose, and holocellulose.

In yeast production, peat provides a wide variety of simple organic compounds in which the Candida yeast grows. This yeast is an efficient producer of high-quality protein and hence can be used on a large scale as livestock feed. This industry is now being seriously considered in the USSR. Peat can also be used as a culture medium for yeasts with high-fat and high-carotene contents.

Medicinal products are derived from peat. Peat tars are antiseptic and are potent germicides. In the USSR, torfot is used to treat progressive myopia, myopic choriorentinitis, opacification of the vitreous humor, opacification of the cornea resulting from keratitis, and early retinal degeneration. In more recent years, it has reportedly been used to treat anemia, hepatitis, and various dermatological, gynecological and neurological diseases. There are potential applications for steroids, triterpenoids and other physiologically active substances found in peat.

Humic acids applied to crop plants result in an increased resistance to pests and an increased yield of sugar and other carbohydrates. The use of humic acid as a soil additive has been patented.

Energy is produced from peat coke, peat charcoal, activated carbon, methanol, and peat sods.

Distillates from peat tar include phenols, fatty acids, bases, methanol acetone, aldehydes, and esters.

Peat is also used in peat boards, peat pellets, instant lawns, peat paper, building materials, oil-absorbing material, kitty litter, stable litter, and disposable diapers.

NEW BRUNSWICK PEAT MOSS PRODUCTION

1958 - 1984

YEAR	QUANTITY (TONNES)	VALUE ($)	VALUE (1984 $)	MINERAL PRODUCTION (% OF $ TOTAL)
1958	19 056	701 000	2 792 784	4.31
1959	22 686	809 000	3 185 033	4.48
1960	19 056	833 000	3 241 203	4.88
1961	29 946	1 240 000	4 787 640	6.58
1962	31 760	1 407 000	5 370 097	6.45
1963	29 038	1 067 000	3 996 235	3.76
1964	24 501	867 000	3 199 230	1.78
1965	51 724	1 532 000	5 510 757	1.86
1966	60 799	1 480 000	5 138 856	1.64
1967	70 780	2 017 000	6 745 655	2.23
1968	69 873	2 211 000	7 109 249	2.50
1969	79 855	2 573 000	7 916 863	2.72
1970	65 336	2 398 000	7 158 030	2.29
1971	61 706	2 476 000	7 176 686	2.31
1972	82 577	3 368 000	9 329 360	2.80
1973	66 243	3 456 000	8 883 994	2.13
1974	90 744	3 500 000	8 101 800	1.60
1975	81 670	5 458 000	11 418 136	2.35
1976	86 207	5 800 000	11 283 900	2.27
1977	96 189	6 784 000	12 223 411	2.53
1978	107 078	8 732 000	14 456 699	2.85
1979	118 875	10 049 000	15 225 239	1.89
1980	124 000	9 707 000	13 351 978	2.41
1981	94 000	9 985 000	12 205 664	1.88
1982	155 000	15 948 000	17 601 807	3.20
1983	151 000	9 792 000	10 220 889	1.93
1984	145 000	12 831 000	12 831 000	2.12

POTASH

Potash is produced in the Sussex area of New Brunswick.

Fertilizers made from potash include potassium chloride, potassium sulfate, and manure salts (KCl + NaCl).

Chemicals made from potash include potassium carbonate, potassium hydroxide, potassium nitrate, potassium phosphate, and potassium silicates.

NEW BRUNSWICK POTASH PRODUCTION

1980 - 1984

YEAR	VALUE ($)	VALUE (1984 $)	MINERAL PRODUCTION (% OF $ TOTAL)
1980	339 692	467 246	0.08
1981	-	-	-
1982	-	-	-
1983	1 726 663	1 802 290	0.34
1984	19 784 900	19 784 900	3.28

QUARTZ (Silica and Silicon)

Silica products are either in a liquid or powdered form.

Synthetically derived silica includes xerogels, hydrogels, pyrogenic silica, precipitated silica, colloidal silica, and sols. They are used as binding, bonding, and antislip agents.

Prepared cristobalite is used in investment casting to compensate for metal shrinkage.

Electrometallurgical gravel, a prepared silica material, is used in the production of elemental phosphorus, silicon alloys, granular mix for acid refractory shapes, manufactured abrasives, soluble silicates, and glass making.

Silica is also used as blasting sand, filler media, and foundry sand.

NEW BRUNSWICK QUARTZ PRODUCTION

1978 - 1984

YEAR	QUANTITY (TONNES)	VALUE ($)	VALUE (1984 $)	MINERAL PRODUCTION (% OF $ TOTAL)
1978	-	105 000	173 838	0.03
1979	28 950	324 000	490 892	0.06
1980	-	475 000	653 363	0.12
1981	-	1 000 000	1 222 400	0.19
1982	-	1 400 000	1 545 180	0.28
1983	-	1 400 000	1 461 320	0.28
1984	-	1 250 000	1 250 000	0.21

SALT

Salt is used for snow and ice removal.

In the industrial chemical industry, salt is used in making sodium hydroxide (caustic soda), chlorine, sodium carbonate (soda ash), sodium chlorate, sodium bicarbonate, sodium chlorite, and sodium hypochlorite.

Salt is also used as table salt, in food processing (e.g., fruit, vegetable, meat, fish and dairy products). It is used in pulp and paper mills, textile mills, leather tanneries, bakeries, grain mills, and breweries.

NEW BRUNSWICK SALT PRODUCTION

1980 - 1984

YEAR	QUANTITY (TONNES)	VALUE ($)	VALUE (1984 $)	MINERAL PRODUCTION (% OF $ TOTAL)
1980	915 024	1 258 616		0.23
1981	116 976	142 991		0.02
1982	911 126	1 002 609		0.18
1983	2 477 137	2 585 636		0.49
1984	7 457 538	7 457 538		1.23

SULPHUR DIOXIDE & SULPHURIC ACID

Sulphur dioxide is used in:

- fertilizers
- stock and poultry feed
- paper pulp
- paper and paper products
- miscellaneous chemicals and explosives
- rubber products
- abrasives
- foundry
- wire and cable
- starch
- glass and glass products
- paint and varnish

Sulphuric acid is used in:

- uranium and metal mines
- petroleum and gas industries
- sugar, vegetable oil and miscellaneous food processing
- leather industries
- textile industries
- pulp and paper mills
- smelting and refining
- electrical product industries
- nonmetallic mineral products
- fertilizers and industrial chemicals
- plastics and synthetic resins
- soap and cleaning compounds
- explosives

NEW BRUNSWICK SULPHUR IN SMELTER GAS PRODUCTION

1958 - 1984

YEAR	QUANTITY (TONNES)	VALUE ($)	VALUE (1984 $)	MINERAL PRODUCTION (% OF $ TOTAL)
1958	-	23 000	91 632	0.14
1959	-	-	-	-
1960	-	-	-	-
1961	-	-	-	-
1962	-	-	-	-
1963	-	16 000	59 925	0.06
1964	-	17 000	62 730	0.03
1965	-	-	-	-
1966	-	-	-	-
1967	20 871	226 000	755 834	0.25
1968	32 668	531 000	1 707 377	1.60
1969	60 799	896 000	2 756 902	0.95
1970	22 686	231 000	689 535	0.22
1971	19 964	168 000	486 948	0.16
1972	28 131	232 000	642 640	0.19
1973	29 946	440 000	1 131 064	0.27
1974	36 298	635 000	1 469 898	0.29
1975	42 650	586 000	1 225 912	0.25
1976	39 020	781 000	1 519 436	0.31
1977	46 279	1 211 000	2 181 980	0.45
1978	57 169	1 155 000	1 912 218	0.38
1979	60 799	1 264 000	1 915 086	0.24
1980	52 000	1 341 000	1 844 546	0.36
1981	85 000	5 478 000	6 696 307	1.03
1982	80 000	2 328 000	2 569 414	0.47
1983	88 000	3 825 000	3 992 535	0.75
1984	119 000	7 827 000	7 827 000	1.30

NONMETALS

Minor Potential for Production and/or Not Actively Sought

Barite
Celestite
Nepheline Syenite & Feldspar
Phosphate

BARITE

In the drilling industry, barite is used as a weighting agent to control density in oil- and gas-well drilling muds.

In the paint industry, barite is a special paint filler or "extender pigment". This is a vital constituent that provides bulk, improves consistency of texture, surface characteristics and application properties; it controls prime pigment settling and paint viscosity. A degree of light scattering is attributed to barite used in highly pigmented distemper or latex paints, allowing it to function as a pigment.

In the glass industry, barite increases the workability of glass, acts as a flux, assists decoloration and increases the brilliance or lustre of the product.

In the rubber industry, barite is used as a filler in some rubber goods.

Barite consumption: Drilling industry.....90%

CELESTITE

In the chemical industry, celestite is used to produce strontium compounds, principally strontium carbonate and strontium nitrate. In the sulphate form, it is used for purifying electrolytic zinc. Strontium carbonate is primarily used in glass faceplates for colour television picture tubes, where it improves the absorption of x-rays emitted by the high voltage tubes.

Celestite is also used in pyrotechnics and signals, and ferrite ceramic permanent magnets that are used in small electric motors.

NEPHELINE SYENITE & FELDSPAR

Nepheline syenite is now preferred over feldspar as a source of alumina and alkalies for glass manufacturing. Its use results in more rapid melting of the batch at lower temperatures, thus reducing fuel consumption, lengthening the life of furnace refractories and improving the yield and quality of the glass. Other industrial uses include ceramic glazes, enamels and fillers in paints, papers, plastics and foam rubber.

Feldspars (aluminum silicates of potassium, sodium, and calcium) are a source of alumina and alkalies for glassmaking. They are used in ceramic bodies and glazes, in cleaning compounds as a moderate abrasive, and as a flux coating on welding rods. Rocks such as labradorite (calcium-rich) and anorthosite (a feldspar-rich rock) have limited use as building stones and for other decorative purposes. Potassium feldspar is an essential ingredient in the manufacture of high voltage procelain insulators. Dental span, which is used in the manufacture of artificial teeth, is a pure white potassium feldspar free of iron and mica.

PHOSPHATE

Currently, eastern Canada is supplied with phosphate from Florida. Approximately 300 000 tonnes are used annually at the Belledune Fertilizer plant for the production of diammonium phosphate (DAP).

Elemental phosphorus (P_4) is used to produce technical- and food-grade phosphoric acid. It is also used in the production of amorphous red phosphorus and phosphorus sesquisulphide. Coproducts of elemental phosphorus are ferrophosphorus, carbon monoxide and calcium silicate slag. Ferrophosphorus is a direct source of the phosphorus needed to produce steel.

The fertilizer industry consumes the largest amount of phosphate in the form of diammonium and monammonium phosphate (DAP, MAP).

Calcium phosphate is used mainly as a calcium and phosphorus supplement in the diets of animals and poultry.

STRUCTURAL MATERIALS

Uses and Production Statistics

Clays
Cement
Lime
Sand & Gravel
Stone

CLAYS

Bentonite clays are used in fire-retardant materials, in cosmetics, animal feed, pharmaceuticals, paints (colloidal fillers), and in chemicals for multiple-copy paper. It is used in iron ore pelletizing, as foundry sand bond, as drilling mud, and as an additive to ceramic raw materials to increase plasticity.

Bleaching clays are used in oil refineries as a filtering agent, and in the wine industry as clarifying and decolourizing agents.

The construction industry utilizes clay in the form of fire brick, building brick, paving brick, drain tiles, drain pipes, sewer pipes, chimney linings or vents, roofing tiles, and flooring tiles.

Earthenware and stoneware are made from clay and used for demijohns, churns, crocks, baths, bathtubs, basins, closets, tanks, lavatories, urinals, sinks, tableware, crucibles and covers, electric insulators, and spark plug cores.

NEW BRUNSWICK CLAY PRODUCTION

1958 - 1984

YEAR	VALUE ($)	VALUE (1984 $)	MINERAL PRODUCTION (% OF $ TOTAL)
1958	630 000	2 509 920	3.87
1959	744 000	2 929 128	4.12
1960	705 000	2 743 155	4.13
1961	744 000	2 872 584	3.95
1962	822 000	3 137 327	3.77
1963	623 000	2 333 322	2.20
1964	698 000	2 575 620	10.43
1965	668 000	2 402 863	0.81
1966	619 000	2 149 292	0.69
1967	567 000	1 896 275	0.63
1968	630 000	2 025 702	0.71
1969	585 000	1 799 987	0.62
1970	940 000	2 805 900	0.90
1971	627 000	1 817 360	0.58
1972	668 000	1 850 360	0.56
1974	1 131 000	2 618 039	0.52
1975	1 310 000	2 740 520	0.56
1976	2 464 000	4 793 712	0.51
1977	1 989 000	3 583 780	0.74
1978	2 306 000	3 817 814	0.75
1979	2 500 000	3 787 750	0.47
1980	2 667 000	3 668 459	0.66
1981	1 415 000	1 729 696	0.27
1982	2 200 000	2 428 140	0.44
1983	3 200 000	3 340 160	0.63
1984	3 550 000	3 550 000	0.59

CEMENT

Cement is produced from limestone, cement rock, clay and gypsum. It is used mainly to produce concrete, which is used in residential construction, industrial and commercial_____, public works projects (highways, streets, bridges, airports), schools, and public buildings.

Cement is used to produce hollow blocks, patio tiles, drain pipes and tiles, chimneys, and flooring.

NEW BRUNSWICK CEMENT PRODUCTION

1958 - 1984

YEAR	QUANTITY (TONNES)	VALUE ($)	VALUE (1984 $)	MINERAL PRODUCTION (% OF $ TOTAL)
1958	163 339	2 934 000	11 689 056	18.03
1959	155 172	2 606 000	10 259 822	14.42
1960	147 912	2 544 000	9 898 704	14.90
1961	155 172	2 754 000	10 633 194	14.62
1962	154 265	2 775 000	10 591 342	12.72
1963	147 005	2 659 000	9 958 753	9.38
1964	157 895	2 908 000	10 730 520	5.97
1965	160 617	2 940 000	10 575 474	3.58
1966	221 416	4 141 000	14 378 380	4.60
1967	208 711	3 904 000	13 056 537	4.32
1968	-	2 696 000	8 668 718	3.05
1969	-	3 539 000	10 889 149	3.74
1970	-	3 294 000	9 841 545	3.15
1971	-	2 829 000	8 199 856	2.64
1972	-	4 564 000	12 642 280	3.80
1973	-	5 203 000	13 374 831	3.20
1974	-	5 672 000	13 129 545	2.60
1975	-	5 839 000	12 215 188	2.52
1976	-	8 967 000	17 445 298	3.52
1977	-	10 367 000	18 679 260	3.87
1978	-	15 794 000	26 148 546	5.16
1979	-	15 794 000	23 929 489	2.98
1980	-	14 002 000	19 259 751	3.47
1981	-	15 304 000	18 707 609	2.87
1982	-	17 165 000	18 945 010	3.44
1983	-	8 965 000	9 357 667	1.76
1984	-	9 676 000	9 676 000	1.60

LIME

In the chemical and metallurgical process industries, lime is used as a flux, acid neutralizer, causticizing agent, flocculant aid, hydrolyzer, bonding agent, absorbent, and raw material.

Dead-burned dolomite is used as a refractory material.

Dolomitic lime is used to manufacture magnesia and magnesium metal, and in slimes of flotation processes. In water treatment (municipal potable water, industrial process water), dolomitic lime controls pH, is a coagulant to remove turbidity, absorbs iron, manganese and organic tannins, and is a sterilant.

For sewage treatment, dolomitic lime chemically precipitates phosphates, and controls pH and nitrogen levels. For pollution abatement, it neutralizes acid drainage from mines, chemical plants, and pulp and paper mills. In paper mill wastes, dolomitic lime clarifies and removes colour. It also is used in scrubbing sulphur dioxide and fluorine from chimney stacks.

In the chemical industry, lime is used in the production of alkalies, carbides, bleaches, and inorganic and organic compounds. Ammonia is recovered by the Solray Process. Caustic soda (sodium hydroxide) is manufactured from quicklime. Calcium carbide, also manufactured from quicklime, is used to generate acetylene. Calcium hypochlorite is used in paper plants for bleaching pulp. Lime is used in the production of caustic magnesia, chrome chemicals, USP food grade salt (made from purified salt brines), and monocalcium, dicalcium, and tricalcium phosphates. Pesticides include lime-sulfur sprays and powders, Bordeaux mixtures (copper sulfate and lime), and calcium arsenate. Lime is required in the manufacture of ethylene and propylene glycols (organic compounds) by the chlorohydrin process. Calcium-based organic salts include calcium stearate, acetate, lactate, and lignosulfonate. Lime is used in the refinement and concentration of citric acid and glucose, and in dyes and dyestuff intermediates.

In the building industry, glass manufacturing requires lime as a flux raw material. Calcium silicate building products include solid sand-lime brick and block, cellular concrete block, insulation panels, micro-porite, paints (casein), varnishes, pigments, whitewash, and proprietary water paints for masonry. Some lime is used in exterior plaster or stucco. Lime is used in the finish or white coat of interior plastered surfaces.

In the construction industry, lime is used to stabilize soils by enhancing its plasticity and reducing shrinkage and swelling. Lime used in asphalt as an antistripping agent prevents the aggregate from ravelling from the bituminous binder. It is used in making lime putty and ready-mixed lime-based mortars.

In agriculture, lime controls the pH of soil, and is used for white-washing dairy barns and composting chicken litter.

In food storage facilities, lime absorbs CO_2 to maintain the freshness of fruit and certain vegetables. It is also used to manufacture a common type of lubricating grease, to seal off-shore oil wells, and in tanning (dehair and "plump") hides.

Lime consumption: Chemical & Metallurgical Industries..... 90%

NEW BRUNSWICK LIME PRODUCTION

1958 - 1984

YEAR	QUANTITY (TONNES)	VALUE ($)	VALUE (1984 $)	MINERAL PRODUCTION (% OF $ TOTAL)
1958	16 334	394 000	1 569 696	2.42
1959	16 334	417 000	1 641 729	2.31
1960	15 426	379 000	1 474 689	2.22
1961	15 426	308 000	1 189 188	1.64
1962	15 426	391 000	1 492 329	1.79
1963	15 426	383 000	1 434 450	1.35
1964	4 537	126 000	464 940	0.26
1965	3 630	101 000	363 307	0.12
1966	3 630	100 000	347 220	0.11
1967	2 722	77 000	257 519	0.09
1968	2 722	75 000	241 155	0.08
1969	-	-	-	-
1970	-	-	-	-
1971	-	194 000	562 309	0.18
1972	-	651 000	1 803 270	0.54
1973	-	995 000	2 557 747	0.61
1974	-	1 000 000	2 314 800	0.46
1975	-	1 303 000	2 725 876	0.56
1976	-	1 440 000	2 801 520	0.56
1977	-	2 137 000	3 850 447	0.80
1978	-	2 166 000	3 586 030	0.71
1979	-	1 905 000	2 886 267	0.36
1980	-	3 415 000	4 697 332	0.85
1981	-	2 935 000	3 587 744	0.55
1982	-	3 961 000	4 371 756	0.79
1983	-	4 080 000	4 258 704	0.80
1984	-	5 506 000	5 506 000	0.91

SAND and GRAVEL

Sand and gravel are used chiefly as aggregate (in cement, concrete, mortar, plaster, asphalt) and as fill (for foundations, roadways, rail tracks, and causeways).

NEW BRUNSWICK SAND & GRAVEL PRODUCTION

1958 - 1984

YEAR	QUANTITY (TONNES)	VALUE ($)	VALUE (1984 $)	MINERAL PRODUCTION (% OF $ TOTAL)
1958	3 644 283	1 750 000	6 972 000	10.75
1959	4 624 597	2 896 000	11 401 552	16.02
1960	5 661 615	2 091 000	8 136 081	12.25
1961	4 549 909	2 796 000	10 795 356	14.85
1962	4 653 358	2 791 000	10 652 409	12.80
1963	4 009 074	2 720 000	10 187 216	9.60
1964	4 264 973	2 641 000	9 745 290	5.43
1965	4 146 098	2 639 000	9 492 747	3.21
1966	4 870 236	2 990 000	10 381 878	3.32
1967	6 901 089	4 383 000	14 658 505	4.85
1968	5 773 140	2 140 000	6 880 956	2.42
1969	3 625 319	1 391 000	4 279 968	1.47
1970	6 245 917	1 969 000	5 877 465	1.88
1971	4 523 593	2 593 000	7 515 811	2.42
1972	6 861 162	4 585 000	12 700 451	3.82
1973	8 669 691	10 550 000	27 119 830	6.50
1974	8 257 713	10 500 000	24 305 400	4.80
1975	3 834 846	4 239 000	8 867 988	1.83
1976	3 539 020	4 100 000	7 979 550	1.61
1977	4 990 926	5 200 000	9 369 360	1.94
1978	5 444 646	6 600 000	10 926 960	2.15
1979	7 259 528	11 600 000	17 575 160	2.19
1980	8 819 000	14 800 000	20 357 400	3.67
1981	6 282 000	9 450 000	11 551 680	1.77
1982	6 206 000	8 359 000	9 225 828	1.68
1983	5 668 000	10 830 000	11 304 354	2.13
1984	5 410 000	10 275 000	10 275 000	1.70

STONE

Stone is used as building stone, as chemical and metallurgical additives, as pulverized stone, and as crushed stone.

Building stone is used in the rough state, or as monument and ornamental stone (flagstone, curbstone, paving blocks)

In chemical and metallurgical industries, stone is used in cement plants and lime kilns, in linings for open-hearth furnaces, as a flux in iron and steel furnaces, in glass factories, and in pulp and paper mills.

Pulverized stone is a whiting substitute, asphalt filler, dusting agent in coal mines, and is used for agricultural purposes and in fertilizer plants.

Crushed stone is used to manufacture artificial stone, roofing granules, poultry grit, stucco dash, terrazo chips, rock wool, rubble and riprap, concrete aggregate, road metal, and railroad ballast.

NEW BRUNSWICK STONE PRODUCTION

1958 - 1984

YEAR	QUANTITY (TONNES)	VALUE ($)	VALUE (1984 $)	MINERAL PRODUCTIO (% OF $ TOTAL)
1958	1 906 534	1 910 000	7 609 440	11.74
1959	1 922 868	1 904 000	7 496 048	10.53
1960	1 709 619	1 411 000	5 490 201	8.26
1961	2 684 211	3 156 000	12 185 316	16.76
1962	2 677 858	3 077 000	11 743 985	14.11
1963	4 008 167	4 127 000	15 456 853	14.56
1964	2 774 955	2 982 000	11 003 580	6.13
1965	1 941 924	2 862 000	10 294 900	3.48
1966	3 215 971	3 084 000	10 708 264	3.42
1968	1 940 019	2 935 000	9 437 199	3.32
1969	1 097 096	2 153 000	6 624 566	2.28
1970	11 987 730	2 773 000	8 277 405	2.65
1971	1 298 548	2 900 000	8 405 650	2.70
1972	1 725 045	3 557 000	9 852 890	2.96
1973	2 156 080	4 372 000	11 238 663	2.69
1974	2 177 858	4 600 000	10 648 080	2.10
1975	3 241 379	8 248 000	17 254 816	3.56
1976	2 540 835	7 000 000	13 618 500	2.74
1977	3 085 299	9 200 000	16 576 560	3.43
1978	3 176 044	10 150 000	16 804 340	3.31
1979	3 176 044	10 850 000	16 438 835	2.05
1980	3 266 000	10 800 000	14 855 400	2.68
1981	2 688 000	10 655 000	13 024 672	2.00
1982	2 261 000	11 556 000	13 754 357	2.32
1983	2 087 000	11 310 000	11 805 378	2.22
1984	2 005 000	10 940 000	10 940 000	1.81

CONCLUSION

The decline in the growth rate of world mineral consumption is creating major problems for the mineral industry. Down-sizing, environmental protection, energy conservation, substitution, alternative supply sources, foreign competition, increased production and capital costs are some of the major factors contributing to this decline. Therefore,companies with mining-based economies are pursuing the development of secondary industries that will broaden the manufacturing base and increase consumption of indigenous minerals. It is hoped that, by doing this, the loss of job opportunities in mining will be compensated by new positions created in mineral-based manufacturing. Downstream manufacturing also provides "value added" and may be sufficient to offset losses in income and mining taxes.

The metals industry has been taking the most punishment in recent years. Although the mining, smelting and refining industries have succeeded in reducing some of their costs, both output and sales have decreased by about 20% since 1981. On the other hand, chemical manufacturers and makers of glass, cement and abrasives were able to make profits despite the recession. However, these producers were able to achieve only a marginal 10% profit above the 1981 levels.

While the primary producers of metals and minerals are more severely punished in recessionary periods, it would appear that the downstream manufacturers, though hurt, are more likely to survive.

New Brunswick produces large quantities of copper, lead, zinc, silver, bismuth, antimony, sulphur and potash. It also has major potential to produce gold, molybdenum, tin, construction and industrial materials, peat and oil shales. All of these minerals, and those yet to be sought, can be used in downstream manufacturing opportunities in areas such as:

1. INDUSTRIAL INORGANIC CHEMICALS

   Examples: Caustic soda, soda ash, chlorine, potassium sulphate, sodium sulphate, potassium chloride.
   Minerals Used: Salt, potash, sulphuric acid, limestone.

2. PLASTICS, SYNTHETICS AND INDUSTRIAL ORGANIC CHEMICALS

   Examples: Waxes, polishes, phonograph records, insulation, plastics, waxes, peat carbohydrates, resins, steroids, livestock feed.
   Mineral Used: Peat.

3. DRUGS

Examples: Salts and mixtures for indigestion remedies, antacids, burn and wound dressings.
Mineral Used: Bismuth.

4. SOAPS, CLEANERS AND TOILET PREPARATIONS

Examples: Eye shadow, lipstick, nail polish and powders.
Mineral Used: Bismuth.

5. PAINTS AND ALLIED PRODUCTS

Examples: Pigments, antimony trioxide for paint formulation, stabilizers.
Minerals Used: Antimony, bismuth, lead and titanium.

6. AGRICULTURAL CHEMICALS

Examples: Potassium sulphate, manure salts, lime, diammonium phosphate (DAP).
Commodities Used: Potash, limestone, sulphuric acid.

7. MACHINERY AND PARTS

Examples: Propellers, carburetor parts, pipes, tubes, sheets, reactor parts, shields, die castings.
Minerals Used: Copper, lead, manganese.

8. ELECTRIC TRANSMISSION AND DISTRIBUTION EQUIPMENT

Examples: Wire, plates, generators, transformers, power lines.
Minerals Used: Copper, zinc, tin, lead.

9. ELECTRIC LIGHTING

Examples: Starting, lighting and ignition batteries, tungsten filaments in light bulbs, power cells.
Minerals Used: Tungsten, lead, bismuth, cadmium.

10. COMMUNICATIONS EQUIPMENT

Examples: Transmitters, receivers, radios, electronic parts.
Minerals Used: Copper, gold, silver, tin, zinc.

11. AMMUNITION

Examples: Lead shot, tracer bullets, shell cases, primers, armour-piercing projectiles.
Minerals Used: Lead, copper, antimony, tungsten.

12. ABRASIVES

Examples: Sandpaper, blasting sand, emery cloth, grinding compounds.
Minerals Used: Silica sand, tungsten powder.

13. CERAMICS AND GLASS

Examples: Engine parts, insulators, sinks, toilet bowls, pipes, tiles, pottery, china.
Minerals Used: Silica sand, clay.

14. BUILDING MATERIALS

Examples: Wallboard, decorative stone, tombstones, plaster, tiles.
Minerals Used: Gypsum, granite, slate, shale limestone.

15. JEWELLERY AND COINS

Examples: Coins, medals, medallions, charms, bracelets, necklaces.
Minerals Used: Copper, gold, silver, polished stone.

16. ALLOYS

Examples: Brass, bronze, Babbitt metal, die cast metals, solders, type metal, pewter.
Minerals Used: Copper, lead, zinc, tin, bismuth, manganese.

New Brunswick, despite its small population base, is a major consumer of mineral-based chemicals and materials. Most of this consumption can be traced to well-established manufacturers in related industries such as paint, and pulp and paper. While these local consumers will be able to form a base load, potential New Brunswick manufacturers will have to look at a much broader market to be able to compete successfully.

This report is the first step in seeking downstream manufacturing opportunities utilizing minerals produced in New Brunswick. The next stage is the definition of market opportunities both at home and abroad. Market penetration will require considerable assessment because of the highly competitive nature of the manufacturing industry.